COMMUNITY-BASED REHABILITATION OF DEGRADED LANDS: HOUSEHOLD PARTICIPATION AND FUTURE SUSTAINABILITY IN WEST HARERGE, ETHIOPIA

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ABSTRACT

Land degradation poses a critical threat to household livelihoods and environmental stability in Ethiopia, contributing to declining agricultural productivity and persistent food insecurity. Community-led rehabilitation of degraded lands, which are vital for local livelihoods, emerges as a timely solution to this pressing issue. This study evaluates the households decision on participation rehabilitation of degraded land and future sustainability in the Kunti watershed, West Harerge, Ethiopia. Data was collected from 197 households, categorized as 105 participant and 92 non-participant, alongside secondary sources including reports and literature. Findings reveal that rehabilitation efforts significantly improved local livelihoods by enhancing crop productivity, reducing soil erosion, increasing water availability, regulating rainfall, providing fodder, generating income from cattle fattening, and boosting biodiversity. A logit model analysis identified factors influencing household participation, such as family size, agricultural land size, and proximity to rehabilitation areas, with statistical significance below the 10 % level. To ensure sustainability, the study recommends clear land tenure and user rights, equitable benefit sharing, participatory forest management to foster ownership, greater women's involvement in decision-making, and the development of small-scale enterprises within the rehabilitation sites.

Keywords: Degraded land; Rehabilitation; Community-based; Livelihood; Sustainability

INTRODUCTION

Land degradation is widespread and a serious threat affecting the livelihoods of 1.5 billion people in the world, which is about 10–20 % of dryland degraded, estimated about 12 million ha are degraded each year (Yirdaw *et al*., 2017). It has been long recognized as a major impediment to economic growth and famine alertness in Ethiopia, and efforts have been made to address the problem especially in the last quarter of the 20th century (Berry, 2003). Deforestation and land degradation is a well-recognized as major threat to human-wellbeing and environment due to the resulting loss in biodiversity, soil degradation and significant contribution to greenhouse gas emission (UNCCD, 1994).

In Ethiopia, land degradation is an important problem, the recently satellite image shows that land degradation hotspots over the last three decades cover 23 % of the land area in the

country (Samuel *et al*., 2016). Especially in the highlands have been identified as the most serious environmental problem (Hagos & Holden, 2002). To maintain the problem community and government made several efforts in different levels. The two of the main activities have been soil and water conservation works and the establishment of Area Enclosures (AEs). The implementation of the soil and water conservation activities on a large scale started in the mid-1970s with the help of the World Food Program (WFP) through food for work projects (Betru *et al*., 2005). In 1980, WFP consolidated with Rehabilitation of forest, grazing and agricultural lands project marked the beginning of large-scale soil and water conservation and land rehabilitation programs in the country (Betru, 2003). There are so many socio economic benefit of community based rehabilitation of degraded land. According to (Fanta *et al*., 2024; Mulualem *et al*., 2014), the rehabilitation intervention in Alaba district; it has brought a positive change in the perception of the local people from a negative position to positive at a later phase of implementation. It stated that local communities benefited from collecting thatching grass, fodder for livestock, and construction wood at either low cost or free of charge. The rehabilitation intervention has also had a positive impact on the livelihoods of local people. More over local communities' participation, incorporation of traditional ecological knowledge and practices, consideration of local peoples' short and long-term needs and value systems, clear division of tasks and benefits, strengthening of local organizations are crucial not only for cost-sharing, but also for the long-term success of rehabilitation endeavors (Yirdaw *et al*., 2017).

Household socio-economic characteristics affects community's decision on participating on maintaining restoration efforts of degraded lands (Omer *et al*., 2020). Land use planners and policy makers can encourage community participation on sustainable management practices to improve ecosystem functioning at national and local environment thus improving participation of rural community as the primary stakeholder and achievement of sustainable development on natural resource management (Cherono *et al*., 2019).

The establishment of AEs has been one of the strategies for rehabilitating the degraded hillsides within the catchments delineated for the rehabilitation of degraded land soil and water conservation program (Betru *et al*., 2005). The activity was mainly planned and implemented using a top-down approach without any form of community participation during the Derg regime (Dessalegn, 1994). The establishment of enclosure area in a hurry condition without detailed discussions on how to protect and how to distribute the benefits among beneficiary households; Since, there was no clear responsibility to make less participatory in decisions on issues pertaining to ownership and protection, access, management and utilization practices, and future development directions (Betru *et al*., 2005).

METHODOLOGY

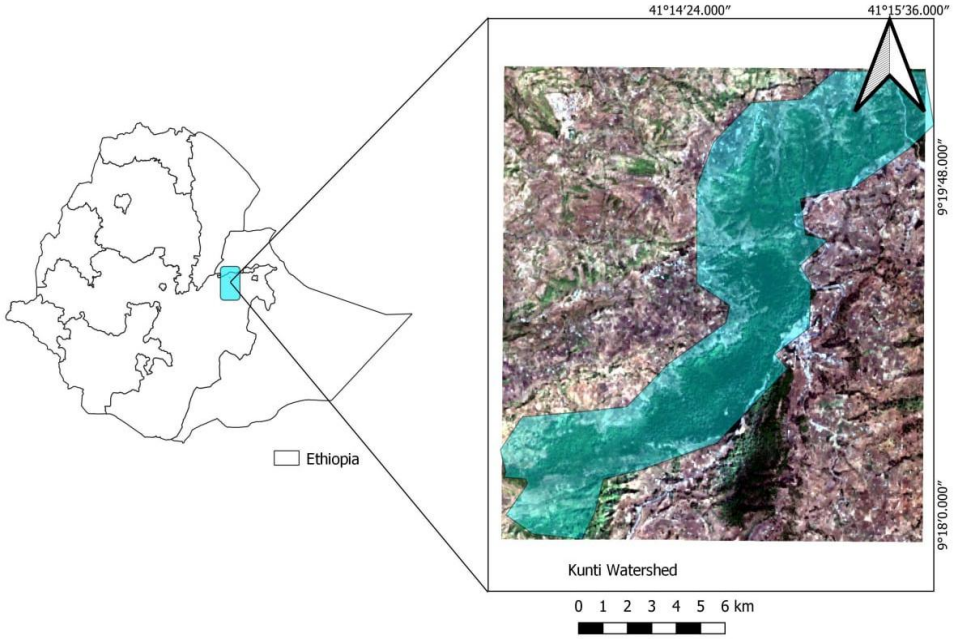
Study area description

The study was conducted on Eastern Ethiopia Oromia Regional State West Harerge Zone Doba Woreda Bukelcha Biftu Kebelle in Kunti Watershed site, which is about 380 km far Addis Ababa. Specifically located on the main roadside of Addis Ababa to Dire Dawa in Bekelcha Biftu Kebelle that established in 2004 by the coordination local government administration and Sustainable land management project (SLMP).

Doba Woreda is found in the altitude varies from 1,500 in the north to over 2,500 m in the south. The slopes are steepest in the highland area along the main road. Annual varies from 750 mm in the lower parts of the wereda to 1,250 mm in the higher parts. The dominant soils include Nitosols, Cambisols and Vertisols. High erosion hazard values (50 t/ha/yr or more)

are found in the highland areas. Geographically: UTM (9° 7' 34.30016"- 9° 28' 54.97206"N) latitude and 40° 53' 57.07427"E – 41° 15' 35.9261"E) longitude.

Fig. 1: Map of the study area



Sampling Techniques and Sample Size

First stratified the targeted households depending of the residence of the communities far from the community based rehabilitated site for comparative analysis of participants and non-participant households. Then random sampling procedure was employed to select number of sample households from participant and non-participant category. According to Cochran (1963) sampling techniques,

When the population size (N) is finite, the formula is adjusted:

$$n = \frac{ni}{1 + \frac{ni - 1}{N}}$$

$$n = \frac{384.16}{1 + \frac{384.16 - 1}{402}} = 197$$

Where

n: sample size.

N: Population size (402)

Accordingly, from a total of 402 households 197 households were selected sample (105 participants, and 92 non-participant) household were participated on household survey.

Source of Data

For this study, both primary and secondary data sources were collected in the form of quantitative and qualitative information.

Table 1: Summary of source data

No	Data source	Data gathered
1	Woreda administration	Key informant interview, documents
2	Kebelle agricultural office	Key informant interview, documents
3	Household	Household survey, Focus group discussion, Key informant interview
4	Literature	Literature review

Data analysis

Both descriptive and statically analysis were employed to analysed the socio economics impact of community based rehabilitation degraded, determinant factors that affects household decision on participation rehabilitation of degraded land, it its sustainability. Examined independent and dependent variables correlation test also done by using STATA software.

Model Specification

One aim of this study was to analyses which of the hypothesized independent variables are related to the households' participation in integrate degraded land rehabilitation practices in communal level based. The dependent variable in this case was a dummy (binary) variable, which take the value zero or one depending on whether or not households were to participate in degraded land rehabilitation activities.

Logit model:

Hence, the logistic regression model for estimating the probability of household participation on rehabilitation of degraded land activities. pi donates the probability to participate in communal land rehabilitation activities

(Pi) is specified as follows.

$$Pr\ (Yi = 1) = Pi\ = \frac{1}{1+e^{-z}t} = \frac{e^{z}t}{1+e^{z}t} \text{.....1}$$

Similarly, probability of non- participant

$$Pr\ (Yi = 0) = 1 - Pi\ = \frac{1}{1+e^{z}t} \text{ ... ... 2}$$

When dividing (1) by (2), it gives odds ratio:

$$\frac{pi}{1-pi} = e^{z}\,\text{t} \text{ .....3}$$

The logit model is a logarithmic transformation of the odds ratio.

$$Li = \ln\left(\frac{pi}{1-pi}\right) = Zi = \beta 0 + \beta 1X1 + \beta 2X2 + \beta 3X3 + \text{ ... ... } \beta kXk + ei$$

Where Li is the log of the odds ratio; e is the base of natural logarithms; β0 is a constant; X1, X2,…, Xk X1, X2,…, Xk are explanatory variables; β1, β2,…βk are estimated parameters corresponding to each explanatory variable; k is number of explanatory variables; and ei is the random error.

RESULTS AND DISCUSSION

Socio economics and Biophysical characters of the respondents

The data from the household survey (Table 1) revealed that 81.2 % the respondents' were male-headed, and the rest 18.8 % were female-headed. The mean age of the household headed was 40.91 year with a range of 26 - 64 years old. The mean year of households stayed around the rehabilitated site 38.11 year with a range of 20- 64 years. The average family size in one household was 4.49 person with 2 and 11 person per household minimum and maximum respectively.

The educational status was categorized in to three groups that are illiterate, primary and secondary school and College University founds 61.42 %, 31.98 % and 6.6 respectively. Occupation of the households were 76.1 %, 18.8 % and 5.1 % Farmers, petty trade and civil servant respectively. The land ownership of the households for farmland, homestead, agroforestry, and grazing purpose was found in average 0.9ha with 0.125-2 ha minimum and maximum, and the household's settlement far from the rehabilitated area 3.1 km in average with range of 0.3 – 5.6 km.

Table 2: Summary of households' characteristics (Categorical Variables)

Variables	Categories	Freq.	Percent	Cum.
Sex	Male	37	18.78	18.78
	Female	160	81.22	100
Education	Illiterate	121	61.42	61.42
	Primary and Secondary School	63	31.98	93.4
	College University	13	6.6	100
Occupation	Farmer	150	76.14	76.14
	Petty Trade	37	18.78	94.92
	Civil Servant	10	5.08	100

Table 3: Summary of households' characteristics (Continuous Variables)

Variable	Obs	Mean	Std. Dev.	Min	Max
Age HHH	197	40.91	10.88	26	64
Family size	197	4.49	2.32	2	11
Stayed years	197	38.11	10.09	20	64
Land size	197	0.90	0.36	0.125	2
Distance	197	3.13	1.15	0.3	5.6

Determinants of households' participation on rehabilitation of degraded land

In this part, analysis factors that affect household decision on participation in community-based rehabilitation of degraded land and screen out the most significant predictors of participation. Socio-economic factors hinder decisions to invest and sustain appropriate practices on land degradation (Omer *et al.*, 2020). In addition to this, rehabilitation of degraded land needs the participation of different stakeholders, such as the governmental and non-governmental organizations (Melaku *et al*., 2017). The logit model was employed to analysis the significant explanatory. The result obtained shows that family size, household land holding and distance between household reside to the rehabilitated site were found significantly affects household decision participation on rehabilitation of degraded land in community based participation at probability level (p<10 %).

Table 4: Result of logit model

Participation	Odds Ratio	Std. Err.	z	P>z	dy/dx
SexHHH	0.926	0.496	-0.14	0.886	-0.122
AgeHHH	1.046	0.031	1.52	0.130	0.007
Famsize	0.789	0.082	2.29	0.022**	0.023
Stayedyear	0.977	0.032	-0.7	0.481	-0.008
Educ	0.667	0.239	-1.13	0.259	-0.082
Occup	1.011	0.407	0.03	0.978	0.093
Landsize	0.213	0.152	-2.17	0.030**	-0.161
Dist	0.064	0.028	-6.39	0.000***	-0.092
_cons	80406.320	185340.3	4.9	0.000	

Number of obs = 197

LR chi2(8) = 133.31

Prob > chi2 = 0.000

Log likelihood = -69.47

Pseudo R2 = 0.49

, and * shows significantly at 1 % and 5 % probability level respectively

Family size (FAMSIHH): The result showed that family size has positively and significantly relation to the households to participate in rehabilitation activities at 5 % significant level. Rehabilitation of degraded land activities are labor-intensive activities. The existence of large numbers of family members increases availability of long-run labor forces that push the household to participation rehabilitation of degraded land projects (Melaku *et at*., 2017). The marginal effect of family size 0.023 which indicates one more person in the household increase the participation level by 0.023 (2.3 %) than households less in family size.

Land holding (Landsize): The result showed that the household land holding has negatively and significantly relation to the households to participate in rehabilitation activities at 5 % significant level. The existing of large hectare of farmers owned land size increase intensive labor energy for owned plot land that leads to control farmers' participation on rehabilitation of degraded land on communal level. The marginal effect of land size -0.161, which indicates the increase in land holding of the household by one

hectare, decrease the participation by 0.161(16.1 %) than less land-holding households. The farmers owning smaller land acreage are times more likely to take part in soil erosion and degraded land management management (Cherono *et al*., 2019)

Distance from household residence (Dist): The result showed that the household residence far from the rehabilitated are has negatively and significantly relation to the households to participate in rehabilitation activities at 1 % significant level. Walking distance between the rehabilitation site and the household residence affects community decision on participation of rehabilitation of degraded land in terms of time taken. The marginal effects was found -0.092 which indicates the increase one kilometer far from household residence to rehabilitated site the participation level decrease by 0.092 (9.2 %) than the nearest households.

Women's Participation and Benefits from Rehabilitation of Degraded Land

As Ethiopian policy on land use and ownership gives equal rights to both men and women rights in decision-making are equally recognized (Mwagiru, 1998). However, due to cultural believes and religious reasons women's participation in decision-making forums, especially in public forums, has been limited (Wisborg *et al*., 2000). For instance, regarding representation in meetings where decisions are made for the management of rehabilitation of degraded land and natural resource conservation only one person represents a household, which is usually a male. As it is known men dominantly, control the household resources and often make final decisions both at household and community levels in the country. Women participate in such meetings is less and only when a female heads the household.

In the study area, women are mostly responsible for the collection of fuelwood; indoor activities, and water fetching from long distances. Risen of springs have been invigorated due to rehabilitation works and the water table has generated, opportunities get water in short distance. In fact, that rehabilitation of degraded lands requires intensive labor for rehabilitation and protection that may not be affordable by individual households, and in particular female-headed households, which often lack labor (Betru, 2005).

Rehabilitation Status and Future Sustainability of the Area

Currently, the area is rehabilitated which covered by plantation trees and area enclosure since 2004 for the last one and half decade. As the information gathered from local communities, the rehabilitation interventions have resulted in dramatic biophysical changes within few years. Planted trees, shrubs, integrated with the natural regeneration of woody species has resulted in the formation of forest and covered by grasses and forbs. According to the local communities, respond there was no any natural resource before intervention. It was only farmland and bare land with vegetation cover was like crop, spice and small shrubs, but now it generated dominant tree species like, *Juniperus procera, Podocarpus falcatus cuppress lustanica, Gravilia robusta, Prunus Africana, Olia Africa* and other many tree, shrubs and herbs species. Land degradation affects the types of plant growth in the area (Temesgen *et al*., 2020). The wild fauna, such as *Pig, warthog, rabbit, hyena, hedgehog*, and various species of birds, have been observed in the enclosed area. In general, the diversity of flora and fauna has increased significantly compared to pre-rehabilitation intervention conditions.

The administration and management in coordination with woreda and Kebelle assigned the security guard with the Bureau of Agriculture. However, the ownership and access to trees that the community does not know whether the trees belong to them or to the government. Local communities who are affected most by restoration projects should participate from

project conceptualization to implementation and management (Marques *et al*., 2016). They are not sure whether the trees can be harvested for use or not. The productivity of grass is too less as the tree grow to forest, which is relatively more important for the communities compared to other products (e.g. firewood and timber) from the area. The denied of tree harvest, pruning and thinning silvicultural activities affects the production of grass (Betru *et al*., 2005). As the government and NGOs enforce rules that focus on conservation of tree and the communities are only allowed to harvest dried fallen firewood. Such restriction and ambiguity ownership may affect the sustainability of rehabilitated area. Hence, communities restored the areas with the technical and financial assistance of the government and the NGO the community believe that it is their right to harvest and utilize the tree. Currently there is free grazing of livestock inside the forest area, this would highly affects the regeneration of new seedling and uncomfortable for wildlife. Animal grazing, and particularly goat grazing, has an inherently negative effect on biodiversity (Oba, 2000).

Another important factor that may compromise the sustainability of rehabilitation is the lack of clear strategies from NGOs actively assisting after rehabilitation interventions. Moreover, there is weak linkage and partnership between the community, governmental institutions with respect to information exchange and giving direction of activities after intervention. Therefore, NGO interventions should provide adequate training and create more awareness for local people to help and promote strong collaboration with governmental institutions and communities. Capacity building training even on other topics, like entrepreneur skills, improving health services, family planning, education, and off-farm income-generation activities, in particular for youths and the landless communities have vital role in reducing pressure directly or indirectly on rehabilitated sites (Mulualem *et al*., 2014).

Therefore, increase the linkage between government institution, NGOs and local communities have an essential role on future sustainability of rehabilitated land. The NGOs incentive bilateral and multilateral donor agencies are playing an essential role in supporting the development and management of the rehabilitation of degraded land and area enclosure (Betru *et al*., 2005). The communities also suggested that applying participatory forest management (PFM) would increase the sense of ownership.

RECOMMENDATION

Based on the findings of the study the following recommendations and suggestions are forwarded:

- Awareness and capacity building training should be given to the local community on how to manage and extend the sustainability of the site.
- Compensating the local people, particularly for those loosed their farmland and free grazing land of crop and livestock production is significantly affecting by rehabilitation intervention.
- Increase women participation on rehabilitation intervention and decision making forum.
- Appling Participatory Forest Management (PFM) for enhancing communities benefit from rehabilitated land and increase sense ownership.
- Provide job opportunities and income generation inside the rehabilitated area like bee keeping, Non-timber forest products (NTPF) extraction.
- The status of the site can be exemplary for other degraded land where community based rehabilitation intervention applying now and can serve as experience sharing demonstration site.

CONCLUSION

Being a common problem in Ethiopia, land degradation puts tragic impact on the socio-economic, environment and ecological situation of the country. It reduce the provision of environmental services, food insecurity, social and economic instability and reduction in the ecosystem's flexibility to climate changeability. Therefore, community based rehabilitation of degraded land incorporation with local government admiration and NGOs linkage has vital role on improvement on communities' livelihood and environmental service.

Community based rehabilitation intervention is crucial for the long-term success of a restoration effort. Furthermore, strengthening of local government and non-government organization will enable local communities to implement and sustain rehabilitation activities. Restoration operations should also consider local communities' short and long-term needs and value systems in order to sustain rehabilitation process. A trade-off is needed to meet the desire of local communities and the purpose rehabilitation intervention on the site. This implies that local community socio-economic needs should be taken into account when choosing rehabilitation approaches to extend the sustainability of rehabilitated area.

CONFLICT OF INTEREST

The authors state that they have no conflicts of interest.

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